What is claimed is:

1. A method for determining configuration parameters describing a physical system, the method comprising the steps of

measuring an output signal from the system in response to an input signal, the output signal being related to the configuration parameters by a linear operator, and

directly reconstructing each of the configuration parameters by applying a prescribed mathematical algorithm to the output signal.

Sub a1

2. The method as recited in claim 1 wherein said step of directly reconstructing includes the step of computing a configuration parameter function.

3. The method as recited in claim 1 wherein said step of directly reconstructing includes the step of computing a configuration kernel.

4. The method as recited in claim 1 wherein said step of directly reconstructing includes the step of computing a configuration parameter response function for each of the configuration parameters.

5. A method for estimating a loop composition in terms of loop parameters representative of the loop composition comprising the steps of

energizing the loop from a measurement end with an energy source,

measuring a response signal from the loop at the measurement end,

wherein each of the loop parameters is related to response signal by a linear operator, and

directly reconstructing each of the loop parameters by executing a prescribed mathematical algorithm, determined with reference to the linear operator, on the response signal.

6. The method as recited in claim 5 wherein said step of directly reconstructing includes the step of computing a loop parameter function.

7. The method as recited in claim 5 wherein said step of directly reconstructing includes the step of computing a loop kernel.

8. The method as recited in claim 5 wherein said step of directly reconstructing includes the step of computing a parameter response function for each of the loop parameters.

9. A method for estimating a loop composition of a subscriber loop in terms of loop parameters $X_1, X_2, \ldots, X_i, \ldots, X_N$, the loop having a frequency-domain response $H(\omega, X_1, X_2, \ldots, X_i, \ldots, X_N)$ for the loop parameters, the method comprising the steps of

(a) determining a range for each loop parameter X_i,

(b) for each loop parameter X_i, generating a frequency-domain loop parameter function $F_{X_i}(\omega)$ wherein

$$F_{X_i}(\omega) = \int_{X_1} \int_{X_2} \ldots \int_{X_i} \ldots \int_{X_N} X_i H(\omega, X_1, X_2, \ldots, X_i, \ldots, X_N)\, d X_1 d X_2 \ldots d X_i \ldots d X_N,$$

(c) generating a loop kernel $k(\omega, \beta)$ for all loop parameters wherein

$$k(\omega,\beta) = \int_{X_1}\int_{X_2}\cdots\int_{X_N} H(\omega, X_1, X_2, \ldots, X_N)\ H(\beta, X_1, X_2, \ldots, X_N)\ dX_1 dX_2 \ldots dX_N,$$

(d) generating a parameter response function $g_i(\beta)$ for each loop parameter from the integral relation $F_{X_i}(\omega) = \int_{\beta} k(\omega,\beta)\, g_i(\beta) d\beta$,

(e) energizing the loop from a measurement end with an energy source,

(f) measuring a response signal $H_R(\omega) = H(\omega, X_1, X_2, \ldots, X_i, \ldots, X_N)$ for the loop at the measurement end, and

(g) directly determining each loop parameter X_i from the integral relation $X_i = \int_{\beta} H_R(\beta)\, g_i(\beta) d\beta$.

10. The method as recited in claim 9 wherein step (e) includes the step of computing the inverse of $k(\omega,\beta)$.

11. The method as recited in claim 9 wherein step (e) includes the step of computing the inverse of $k(\omega,\beta)$ using singular value decomposition.

12. The method as recited in claim 11 wherein step (f) includes the step of filtering noise from the response signal.

13. A system for generating the loop composition in terms of loop parameters representative of the loop composition comprising

a source of waves for energizing the loop from a measurement end,

a detector for detecting a response signal from the loop at the measurement end, wherein each of the loop parameters is related to response signal by an integral operator, and

a reconstructor for directly reconstructing each of the loop parameters by executing a prescribed mathematical algorithm, determined with reference to the integral operator, on the response signal.

Sub a1

14. The system as recited in claim 13 wherein said reconstructor includes a processor for computing a loop parameter function.

15. The system as recited in claim 13 wherein said reconstructor includes a processor for computing a loop kernel.

16. The system as recited in claim 13 wherein said reconstructor includes a processor for computing a parameter response function for each of the loop parameters.